FINAL

SAUSAL CREEK WATERSHED ENHANCEMENT PLAN

Sausal Creek "Restoration Reach" in 2003

Prepared by Laurel Marcus and Associates, NewFields River Basin Services, Hydrologic Systems Inc.

For

Friends of Sausal Creek

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SAUSAL CREEK WATERSHED ENHANCEMENT PLAN

I. INTRODUCTION

In the middle of urban Oakland lies a series of parks which shelter Sausal Creek and create a green ribbon through the city. Unlike so many urban streams now flowing lifeless through pipes hidden beneath city streets, Sausal Creek has a natural channel over much of its length. Hikers can follow Sausal Creek and its tributaries from the top of the watershed on Skyline Boulevard down through Palo Seco and Dimond Canyons and past Interstate 580 before the natural creek channel is resigned to a culvert in the Oakland flatlands. Although the effects of its cemented urban drainage are everywhere, Sausal Creek is alive and inspiring. Native trees line the creek in many places and there is a small number of rainbow trout residing in its waters. These remnants of the natural world, gone from most of Oakland, make Sausal Creek a good candidate for enhancement actions, as well as community involvement and education.

The Friends of Sausal Creek (FOSC) formed in 1996 to focus community activities to learn about, protect, and enhance the creek and its watershed. FOSC has completed projects using volunteers to remove invasive non-native plants, install native plants, monitor water quality, control erosion, and complete a major creek habitat enhancement project. FOSC worked with Laurel Marcus & Associates (LMA), a consulting firm specializing in watershed planning, to raise grant funds to complete a plan for the Sausal Creek watershed.

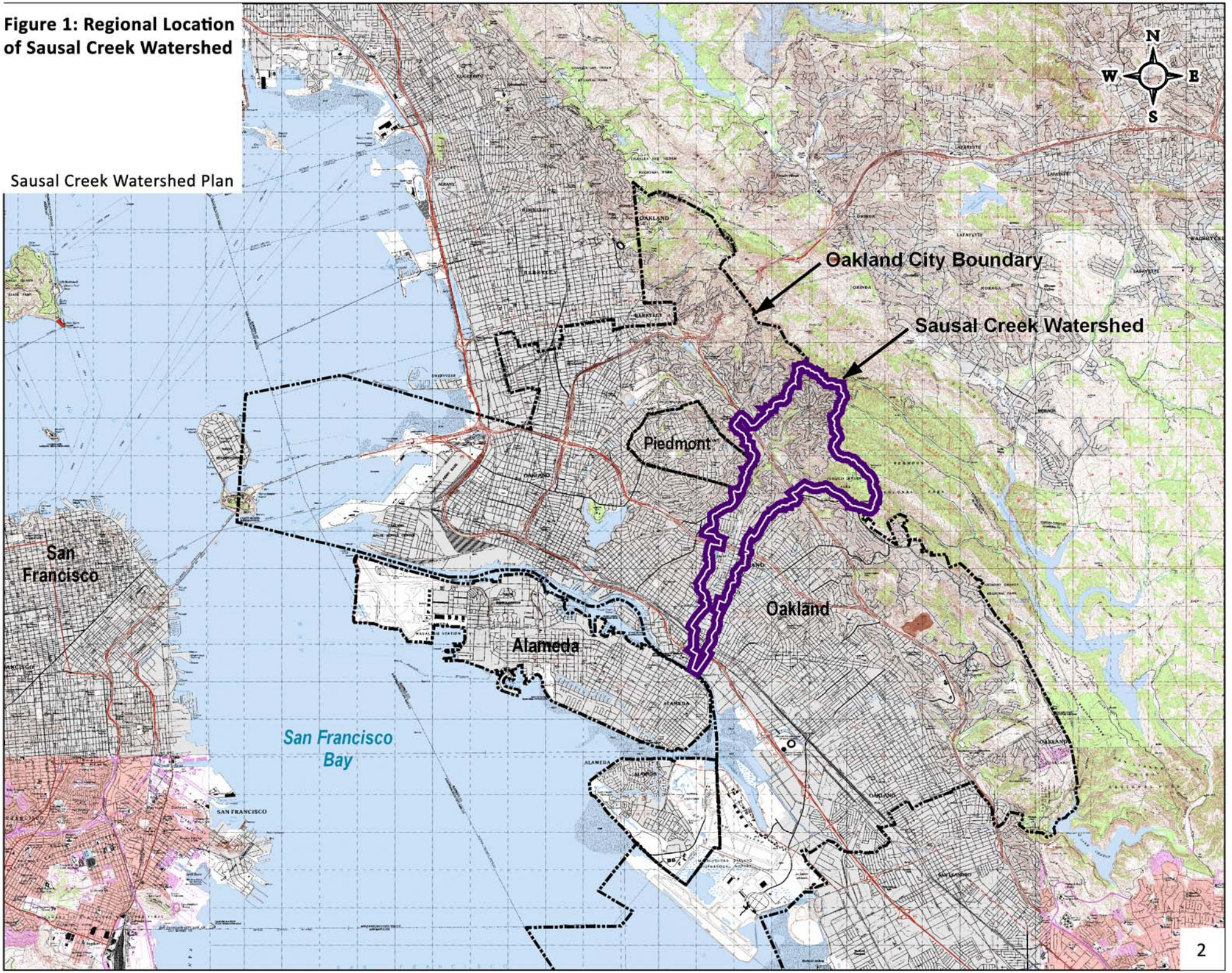
The Sausal Creek watershed covers 4.5 square miles (2,777 acres) in Oakland (Figure 1). Most of the watershed has been developed for residential and commercial land uses. This development has changed the volume and rate of stormwater runoff. Impervious surfaces associated with development are the primary culprits, resulting in faster runoff and lower infiltration rates. The runoff is also collected in the pipes of a storm drain system and discharged into the creek at a few locations. This urbanization process results in peak flood flows well in excess of the natural conditions that formed the creek. These effects of urbanization are further exacerbated by the steep slopes of the upper Sausal Creek watershed.

This plan characterizes the hydrology of the Sausal Creek watershed in order to document a baseline of flow, sediment loading, and channel conditions. From this baseline the degraded hydrological and ecological conditions of the channels, and the watershed processes that resulted in that degraded condition, can be identified. In highly urban watersheds, many factors that adversely impact the creek are intrinsic parts of the developed landscape. Successful restoration or revegetation of urban creeks depends upon evaluation of the larger watershed and implementation of projects that will most offset the effects of urbanization. This plan describes projects to address the conditions that are adversely impacting Sausal Creek and its tributaries, aquatic habitats, and water quality. Enacting a long-term plan to repair and improve the watershed will sustain Sausal Creek for future generations.

This plan for the Sausal Creek watershed will:

- Document the hydrology of the Sausal Creek watershed and identify watershed-based projects that, to the greatest extent feasible, mitigate the effects of urban runoff on Sausal Creek, its habitats and water quality;
- Collect and analyze existing water quality and aquatic insect monitoring data;

Figure 1: Regional Location of Sausal Creek Watershed



- Document erosion problems in the urban storm drain system and recommend improvements to reduce this erosion;
- Discuss the location and extent of non-native invasive plants on parklands and evaluate measures to eradicate these plants and revegetate with appropriate native plant species;
- Identify locations where riparian habitat enhancement can be implemented;

FRIENDS OF SAUSAL CREEK (FOSC)

The Friends of Sausal Creek (FOSC) are a group of residents, teachers, students, merchants, and elected officials working together with the City of Oakland and County of Alameda to improve the Sausal Creek watershed. The Friends Vision Statement expresses the group's hope of creating an intact riparian corridor from the hills to the bay that's accessible to all. The Friends' mission is: "to promote awareness and appreciation of the Sausal Creek watershed, and to inspire action to preserve and protect the creek and its watershed as both a natural and a community resource." Formed in 1996, the Friends recognize that citizen participation is critical for building a long-term commitment to protecting Sausal Creek as a natural resource for the greater Oakland community. FOSC operates a native plant nursery at Joaquin Miller Park

II. BACKGROUND

In 2005 the State Water Resources Control Board (SWRCB) approved an $180,000 grant to the Friends of Sausal Creek (FOSC) to produce a watershed plan for the Sausal Creek watershed. Additional grant funds of $46,000 were provided by the San Francisco Foundation to FOSC. FOSC subcontracted with Laurel Marcus & Associates (LMA) for completion of the watershed plan. LMA also provided matching in-kind services for the state grant.

The grant included the following tasks:

- Collect existing information
- Create Geographic Information System (GIS)
- Collect field data
- Hydrologic and geomorphic analysis evaluation
- Creation of hydraulic model
- Preparation of Draft Watershed Plan
- Urban pollution prevention workshop
- Completion of Final Watershed Plan

Due to State budget problems, work on the grant was stopped December 18, 2008. The grant was restarted in October 2009. During this period, LMA changed the hydrology contractor to NewFields River Basin Services, LLC. to complete the hydrologic and hydraulic modeling for the watershed plan.

Karen Paulsell of FOSC provided extensive information on native and non-native plant species recorded for the public lands in the Sausal Creek watershed. Karen also provided information on the goat grazing management plan for Joaquin Miller Park and completed field assessments of storm drain outlets in the basin. Sara Marcellino served as the project director for FOSC until March 2009, when Kimra McAfee took over the responsibilities of project director.

III. DESCRIPTION AND HUMAN HISTORY OF THE SAUSAL CREEK WATERSHED

The Sausal Creek watershed extends from the Oakland Hills to the San Francisco Bay (Figure 1). The total watershed area is approximately 4.5 square miles. The highest elevation in the watershed is approximately 1,525 ft. NGVD. The lowest elevation of the watershed is approximately sea level or 0 ft. NGVD. Figure 2 depicts the elevations in the watershed showing the mean elevation of the upper, middle, and lower portions of the watershed. Figure 3 depicts the areas of the watershed which have greater than 30% slopes.

Three tributary creeks make up the upper watershed—Shephard or Shepherd Canyon Creek, which drains Shepherd Canyon (spelling difference is an historical anomaly), Palo Seco Creek, which drains Joaquin Miller Park and adjacent lands, and Cobbledick Creek which drains the lands between Chelton Drive and Ascot Drive (Figure 4). Table 1 lists the acreage of each major sub-basin. These three tributaries come together near Highway 13 and form Sausal Creek. Another major tributary which drains the Whittle and Fruitvale Avenues neighborhood joins Sausal Creek near Diamond Avenue. The entire watershed is in the City of Oakland.

Table 1: Tributary Sub-Basins of Sausal Creek Watershed

Sub-Basin	Total Acres	Acres over 30% Slope
Cobbledick Creek	308.74	188.0
Shephard Creek	704.97	441.9
Palo Seco Creek	505.54	266.9
Sausal Creek	1258.4	213.2
TOTAL	**2,777.88**	**1,110.0**

HUMAN HISTORY

Sausal Creek and its tributaries reflect the geology, flood events, land uses, and land conditions of their watershed. The Sausal Creek drainage has changed a great deal over the past 200 years, and its creeks reflect these changes.

The Ohlone

Native Americans, the Huichin Ohlone, lived in the East Bay including the Sausal Creek watershed at a population density of 2 people/square mile in tribelets of approximately 250 people (Lowe 2000). As hunter-gatherers, the Ohlone managed the landscape extensively to produce food and other resources (Anderson 2006). A primary tool was fire. The Ohlone used fire to change the type of vegetation that dominated the landscape and to modify the species composition in other vegetation types. The broad extent of grasslands in the East Bay in the 1700-1800s was likely the result of Ohlone groups setting fires at certain times of the year to reduce bunchgrass thatch, release nutrients, and increase growing area for their food plants (Lowe 2000, Margolin 1978). The Ohlone harvested and replanted numerous plants with fleshy bulbs such as *Brodiaea*. Tule elk, black-tailed deer, rabbits, and many birds favored the perennial grassland created by Ohlone management. Chaparral and forest areas would also have been burned to increase biodiversity, reduce over-growth and create better habitat for game species. Smoke from the fires cleared pest insects out of oak trees, fostering improved acorn production, another major food source for the Ohlone. Management practices also encouraged plants which produced fleshy sweet

Figure 2: Elevations in the Sausal Creek Watershed

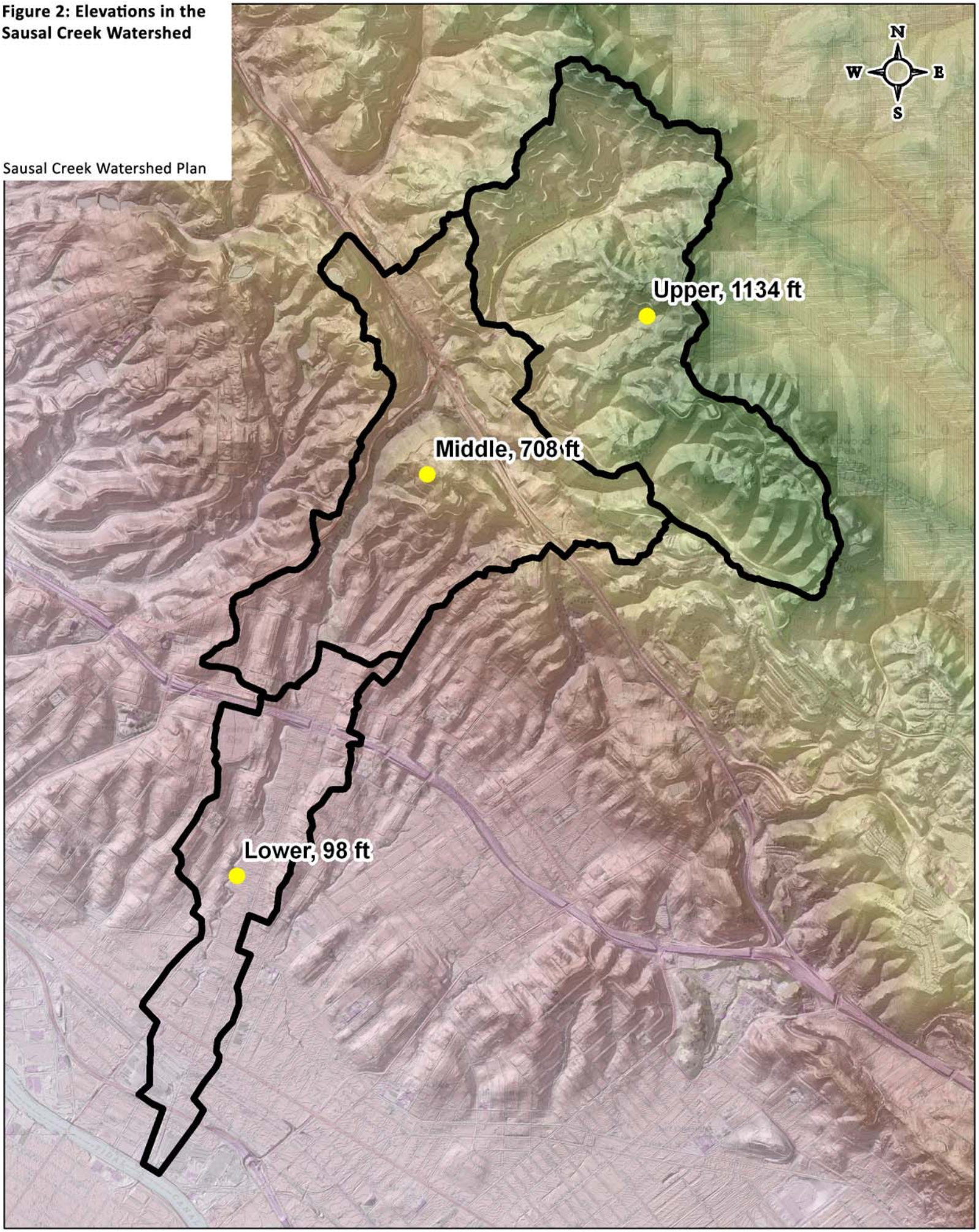
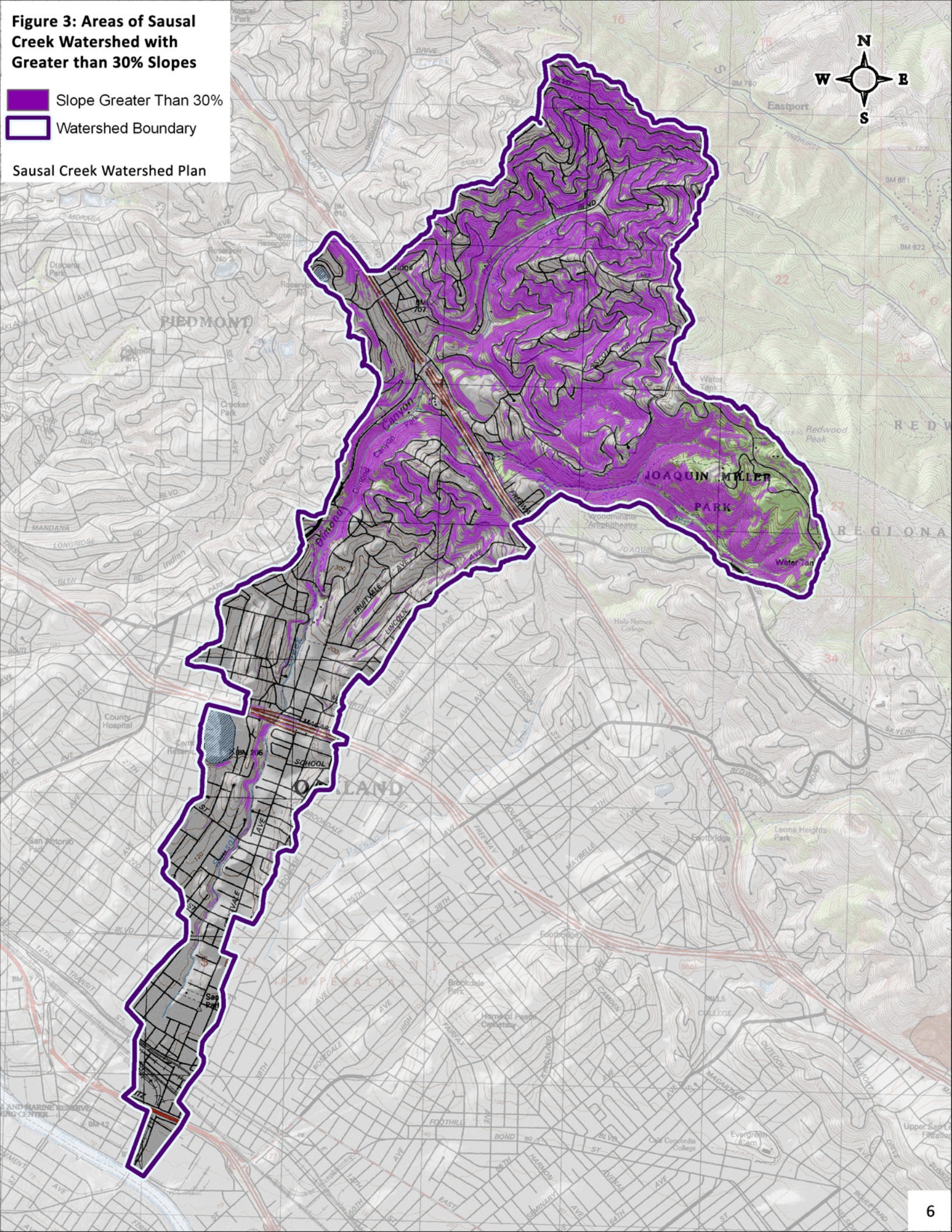


Figure 3: Areas of Sausal Creek Watershed with Greater than 30% Slopes



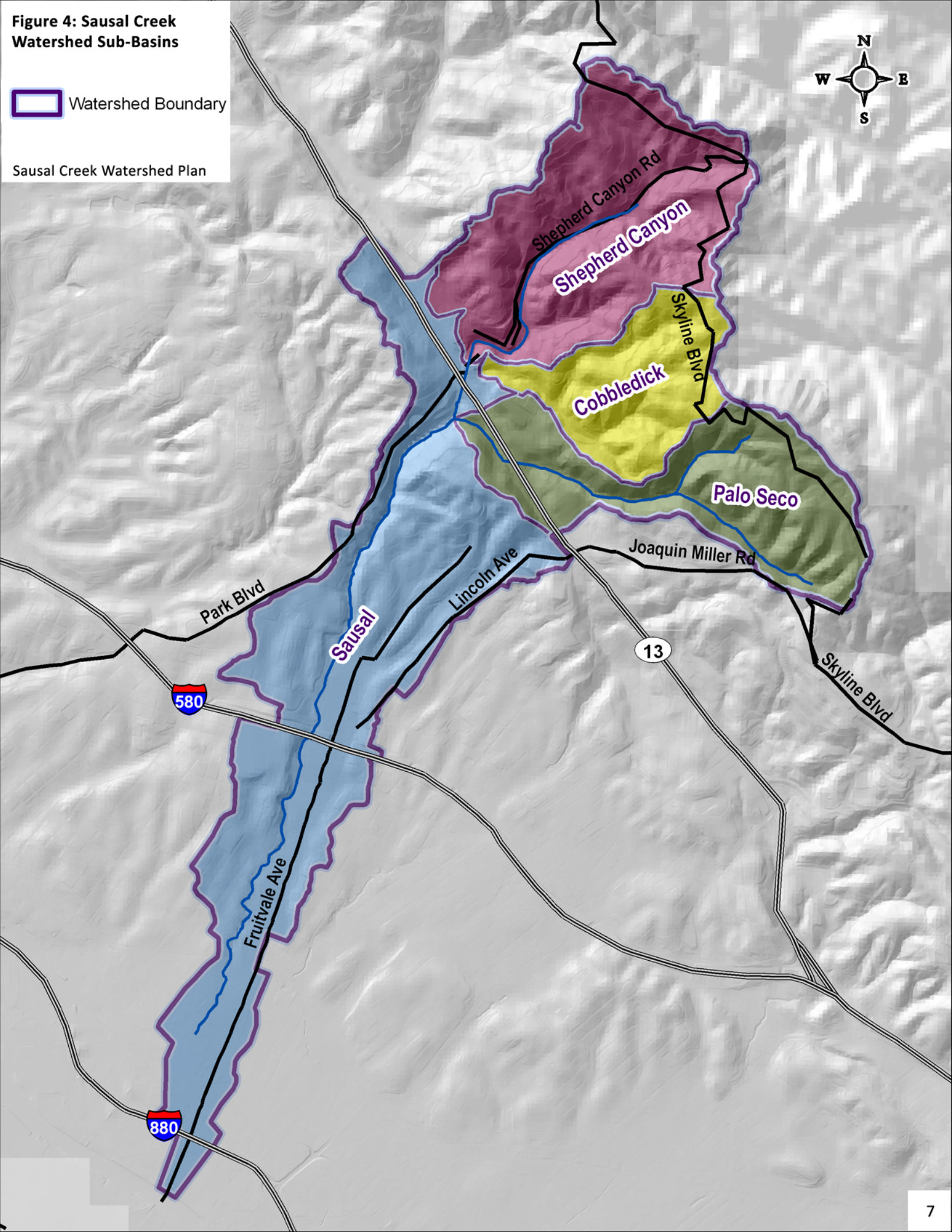


Figure 4: Sausal Creek Watershed Sub-Basins
Watershed Boundary
Sausal Creek Watershed Plan
N
W
E
S
Shepherd Canyon Rd
Shepherd Canyon
Skyline Blvd
Cobbledick
Palo Seco
Joaquin Miller Rd
Park Blvd
Sausal
Lincoln Ave
13
Skyline Blvd
580
Fruitvale Ave
880

fruits. The Ohlone managed plants to produce straight roots and rhizomes and straight branches for use in basket-making. The riparian zones of creek and freshwater marshes were managed for particular plants and to create habitat for waterfowl, another food source.

The Ohlone management of the landscape created particular types of vegetative cover, creek conditions, and habitats based on their need for food and fiber.

The Spanish/Mexican Era

The Anza Expedition explored the Bay Area in 1775-1776. They described the East Bay as a broad, grassy plain with steep hills dissected by creek corridors filled with live oak, bay laurel, cottonwood, sycamore, and alder. This open landscape was likely produced by the land and fire management of the Ohlone. The Spanish originally named Sausal Creek the Arroyo del Bosque, or "stream of the woods," due to the redwoods in the upper watershed.

The Spanish built a series of 21 missions in California including three in the Bay area: San Francisco, Santa Clara, and San Jose. The missions enlisted local native people to provide labor for farming and building. The Spanish also brought European diseases to California, including smallpox, which decimated Native American populations in a very short time. The Spanish banned all Ohlone burning practices and brought cattle and sheep to graze the native perennial grasslands. Combined with the introduction of annual European grasses, these changes resulted in a complete transformation of the grasslands. The Spanish allowed their livestock to range over large areas in low numbers and harvested them for hides, tallow, and meat.

The Sausal Creek watershed was part of the San Antonio Rancho, which stretched from Cerrito Creek to San Leandro Creek and was owned by the Peralta family. The Peraltas had more than 200,000 head of cattle on San Antonio Rancho. The family patriarch, Luis Maria Peralta, split the Rancho between his four sons. Antonio Peralta received the portion of the Rancho containing the Sausal drainage. Antonio built an adobe home near the current intersection of 34th Ave. and Paxton Ave.

The American Era

In 1846 the Americans living in northern California staged the Bear Flag Revolt and in 1850 California became a state. The ownership of Mexican ranchos was settled by American courts and the Peraltas received title to their land but then had to sell much of it to cover legal costs.

In the 1840s, prior to statehood, Americans George Patterson, John Parker, and others started logging the San Antonio redwoods in the headwaters of the Sausal Creek watershed. Some of these redwoods were 300 ft. tall and used as a navigational landmark by ships on San Francisco Bay. Redwoods covered a 5-square mile area encompassing the headwaters of Sausal, Redwood, and San Leandro creeks. This was one of the only locations of redwood forest in the East Bay hills; most other redwoods were in creek canyons (Evanosky 2006).

Over a 20-year period the redwood forest was completely clear cut. There were a number of lumber mills in the area, including one on Palo Seco Creek near the present location of Highway 13 (Figure 5). Over 98% of the redwood forest in the Sausal Creek watershed was clear cut. Between 1870s-1880s, the stumps of the redwoods were taken for shingles and firewood, providing more than half of the firewood

Figure 5: Lumber Mill along Palo Seco Creek in the 1850's. There were 8 mills operating in the area at the time. First growth redwood was the primary tree harvested.

for East Bay households. The redwood forest was burned after logging and then grazed. Many of the original logging roads and skid trails are now used as hiking trails or major roads.

By 1878 there were 10 major landowners in the upper watershed. In 1886 the poet Joaquin Miller built "The Hights" in what later became Joaquin Miller Park, near the lower end of Sanborn Rd. The steep hills of this site are shown in Figure 6 and are largely treeless. Joaquin Miller planted over 75,000 trees, many of which were non-native species such as Eucalyptus and Acacia as well as Monterey pine and Monterey cypress. Most of the lands in the watershed were used for cattle and sheep pasture, dairy, orchards, and row crops. Americans fenced their lands and had many more animals grazing per acre than their Mexican and Spanish predecessors.

Urbanization

Residential development in the watershed started near the Bay where goods were shipped to San Francisco and beyond. In 1871 a stone dam was built across Sausal Creek in Dimond Canyon, located about 0.3 miles downstream of the current location of Highway 13. This reservoir was the water supply for the Fruitvale and East Oakland area until 1920.

Gravel was extracted from the creek at the current location of Fruitvale Ave. and E. 14th Street. A 25-foot deep pit was dug out of the creek and winter floods re-filled it with gravel. An 1878 description portrays lower Sausal Creek with banks of 15-20 feet and a straightened channel. Figure 7 shows the Fruitvale neighborhood near the turn of the century. Figure 8 shows historic photographs of the Montclair area.

In the earliest descriptions of Sausal Creek, the channel ends in a willow grove upstream of the Bay shoreline. Sausal Creek includes an alluvial fan reach below the current location of Highway 13. Alluvial fans are very common in the Bay area due to the tectonic uplift of mountain ranges. Creeks deposit sand, gravel, and cobble in a conical fan as they exit steep rockbound gorges, and spread out on flatter open land. Streamflows percolate into the coarse alluvium of the fan and exit at the base of the fan on the flatlands, often forming wetlands or willow groves. Sausal Creek, like many streams in the Bay area, did not have a creek channel perennially connected to the Bay. Anadromous steelhead would only have had access into Sausal Creek on years when rainfall was high and maintained flows adequate for fish migration through the alluvial fan.

With urbanization the location and condition of Sausal Creek was significantly changed. In 1900 a tidal canal was dredged near the Sausal Creek mouth to make Alameda an island. The downstream reach of Sausal Creek was re-located in 1902 to avoid silting in the new canal; however, the creek was relocated back to its original position a few years later. Over time, the lower portion of Sausal Creek was straightened to maximize development area. Figure 9 shows the topographic map of Sausal Creek watershed in 1897. Streets and buildings are concentrated in the downstream, flatter lands of the drainage. Roads in the upper watershed remain from the logging operations. Roads are indicated where Fruitvale Ave., Park Blvd., Lincoln Ave., Skyline Blvd., and Highway 13 are now located. The original Central Reservoir is also visible with a creek going in and out of the pond. Figure 10 and 11 show Dimond Canyon, Park Boulevard, and Montclair in 1910.

Figures 12-14 show the progression of urbanization of the Sausal watershed. The 1915 map shows more urban development and the Oakland and Antioch railroad extending up Shepherd Canyon and through a tunnel to "Eastport" (Figure 15). The railroad bed is currently a public trail from the Montclair

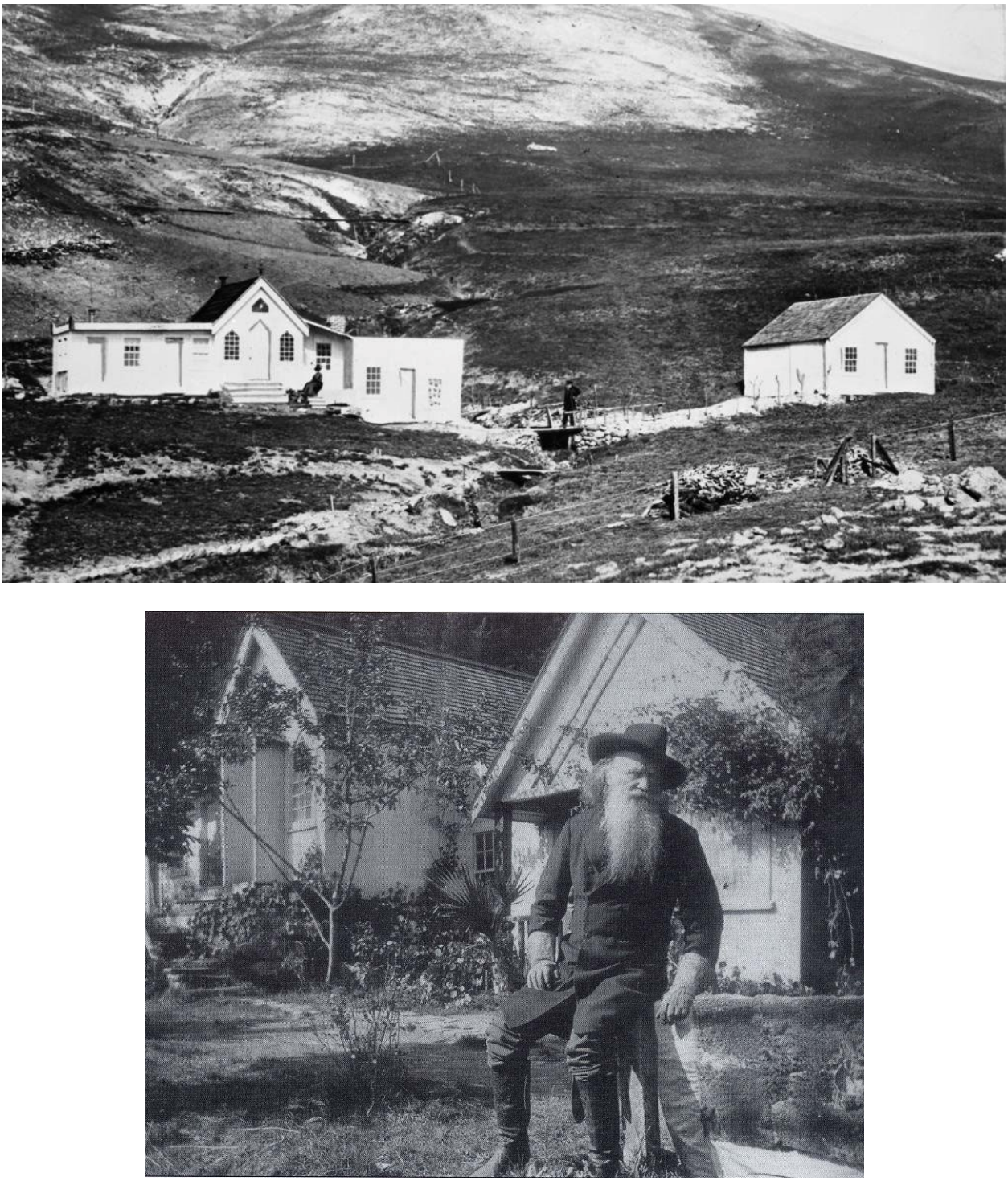


Figure 6: Top: The Hights was built on a treeless hill by Joaquin Miller in 1886. Bottom: Joaquin Miller a few years later after thousands of trees were planted, primarily non-native species like Eucalyptus.

Figure 7: Top: Children swimming in Sausal Creek in the early 1900's. Bottom: The intersection of MacArthur Blvd. (formerly Hopkins St.) and Fruitvale Ave. in 1890.

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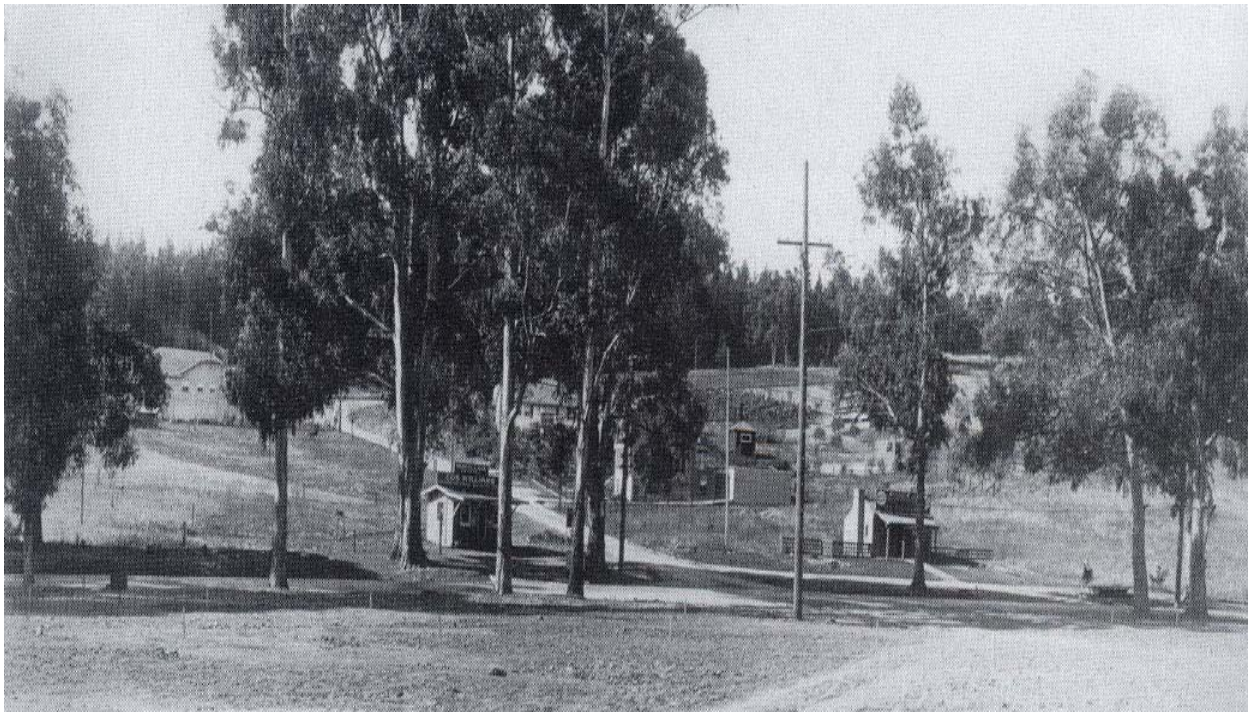

Figure 8: Two views of the Montclair area in the late 1800's to early 1900's.

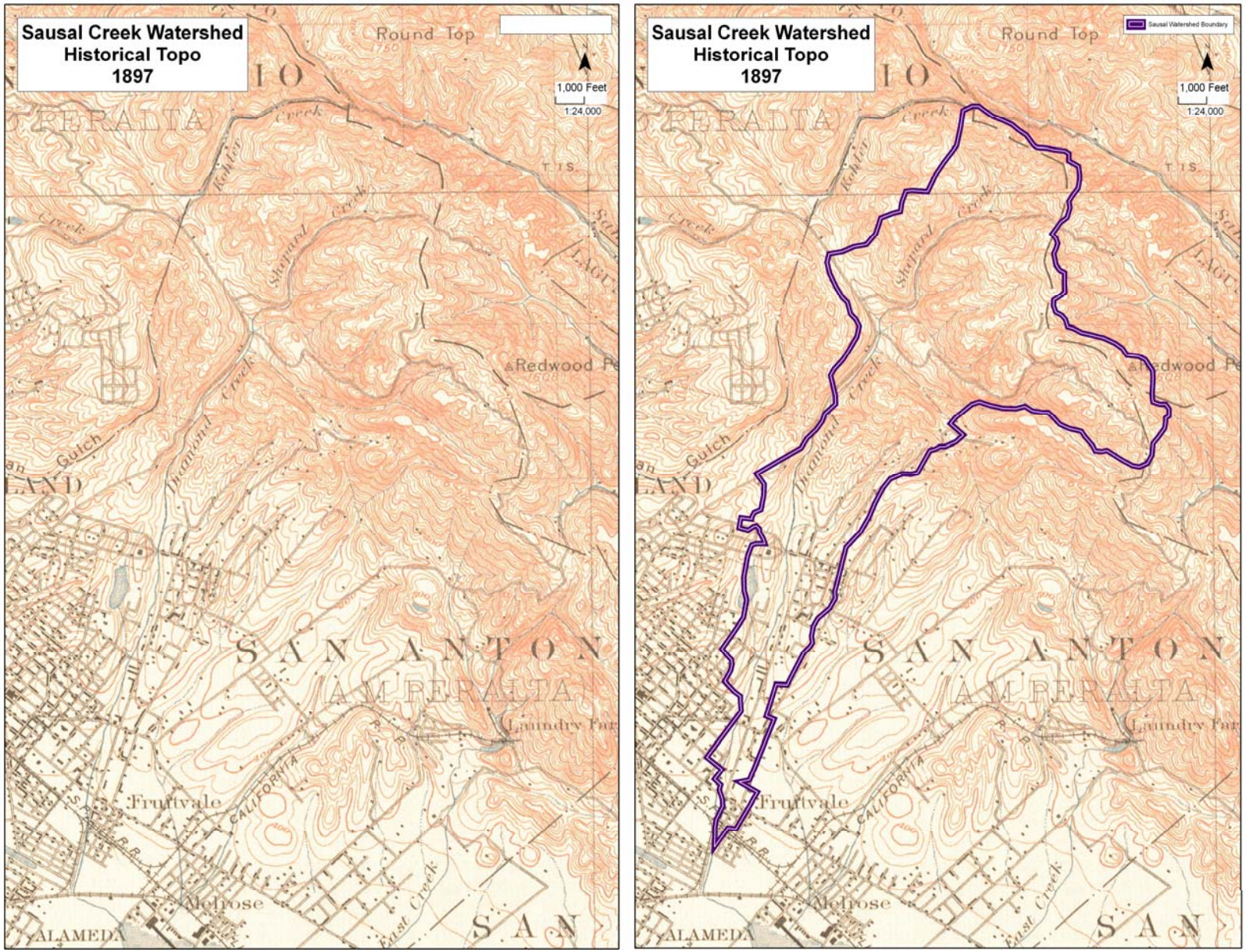

Figure 9: Topographic map of the Sausal Creek watershed in 1897 with and without the watershed boundary.

Figure 10: Dimond Canyon in the early 1900's

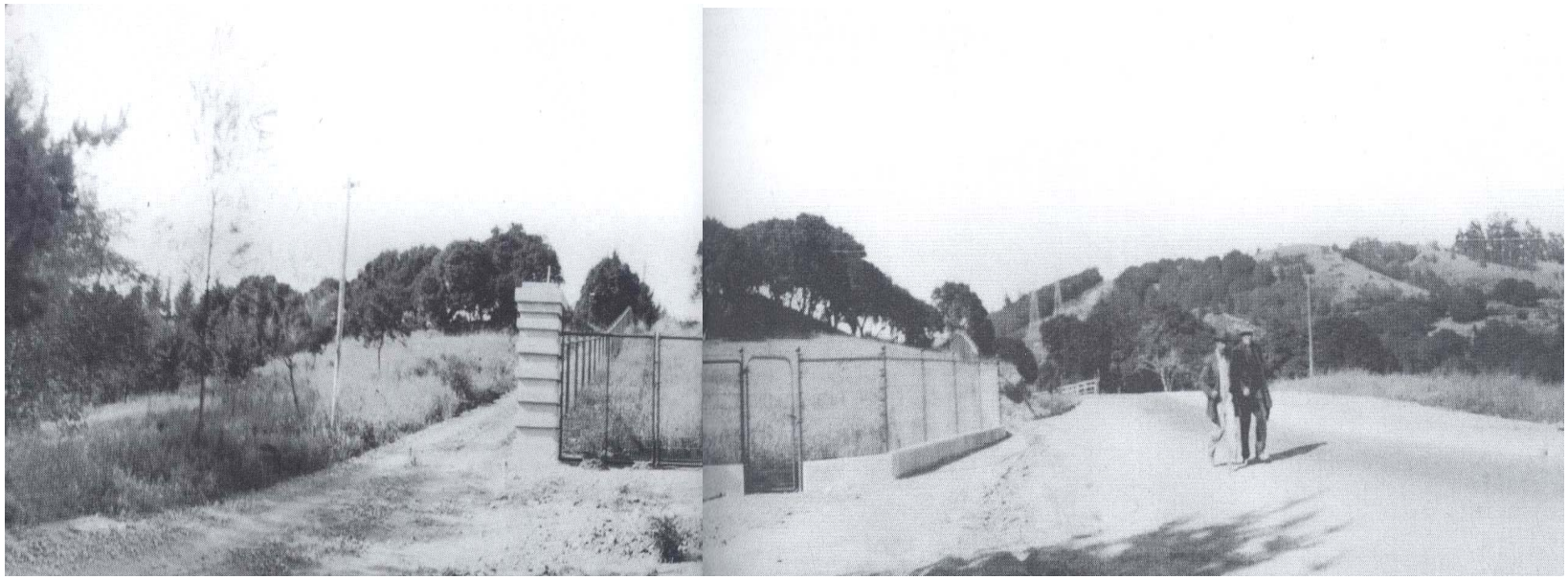

Figure 11: Looking up Park Blvd. into the upper Sausal Creek watershed in the early 1900's.

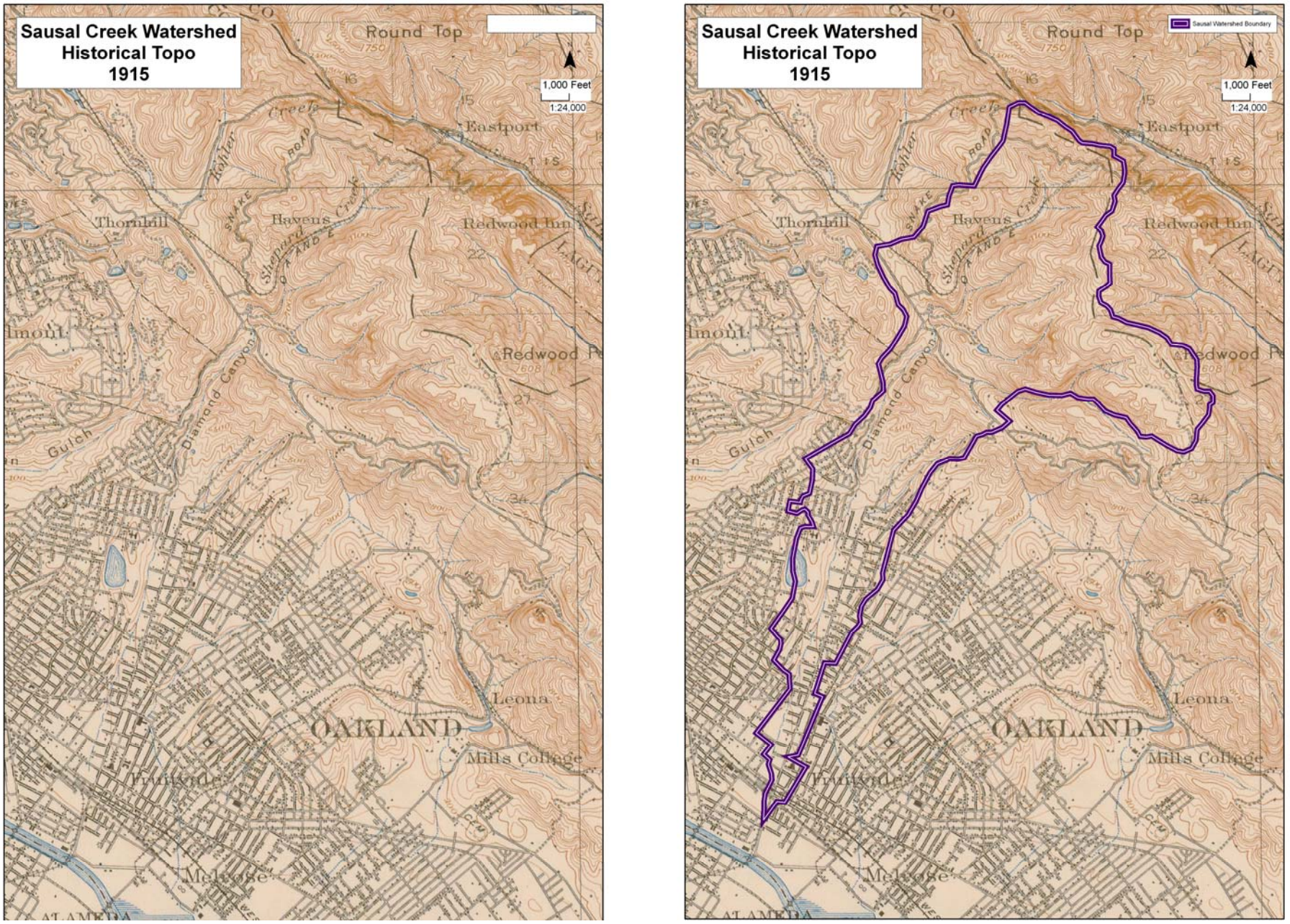

Figure 12: Topographic map of the Sausal Creek watershed in 1915 with and without the watershed boundary

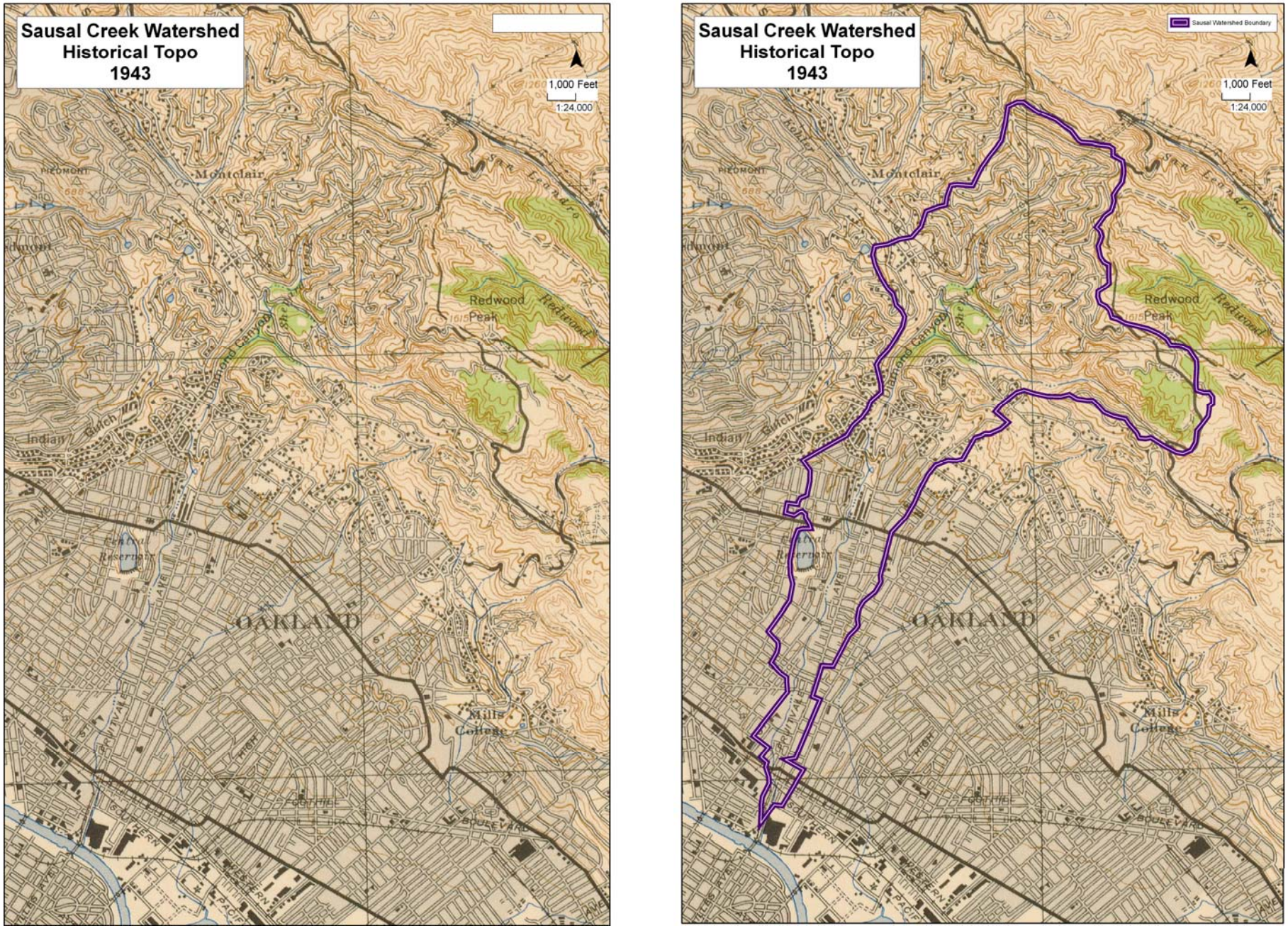

Figure 13: Topographic map of the Sausal Creek watershed in 1943 with and without the watershed boundary

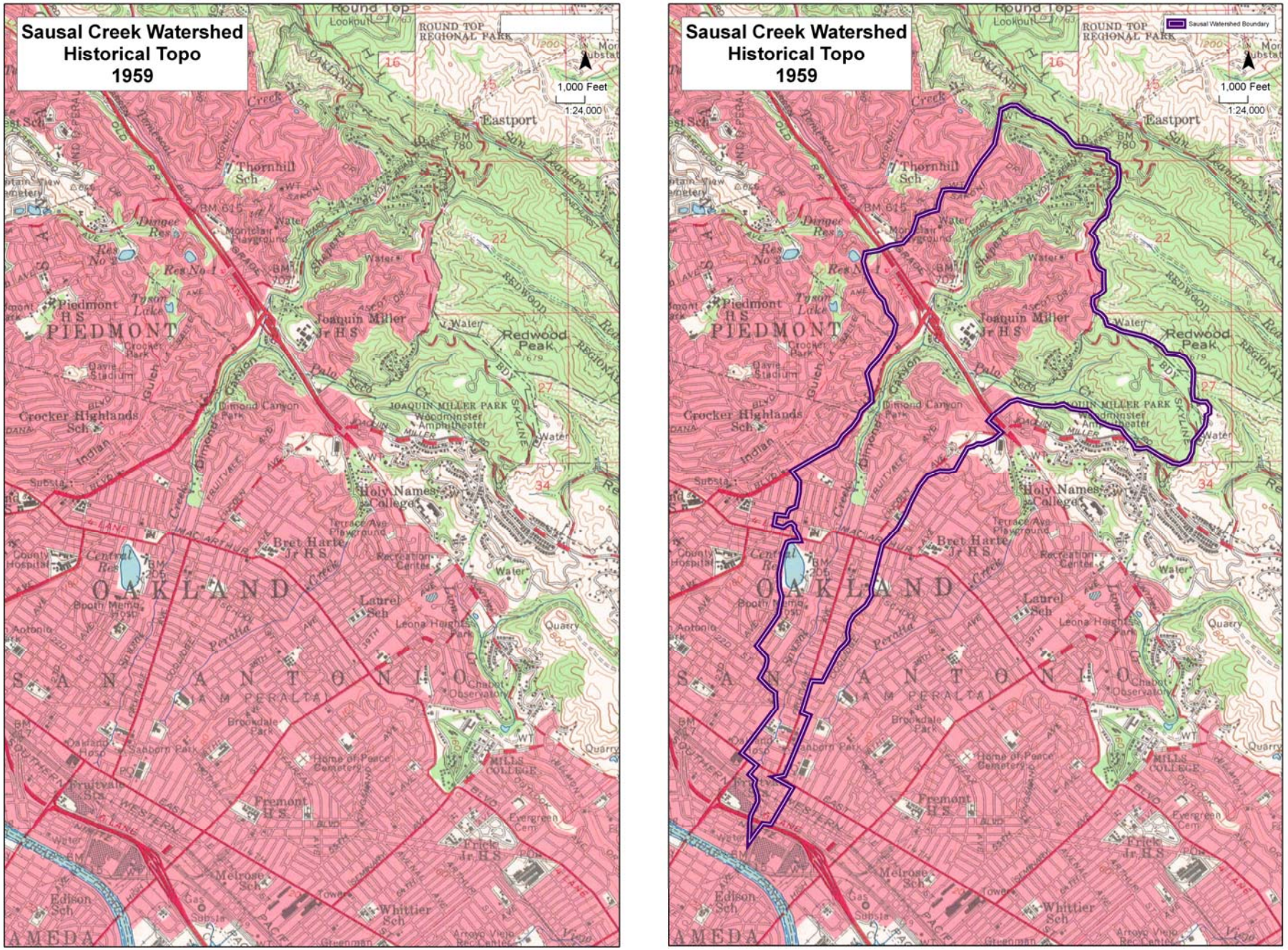

Figure 14: Topographic map of the Sausal Creek watershed in 1959 with and without the watershed boundary

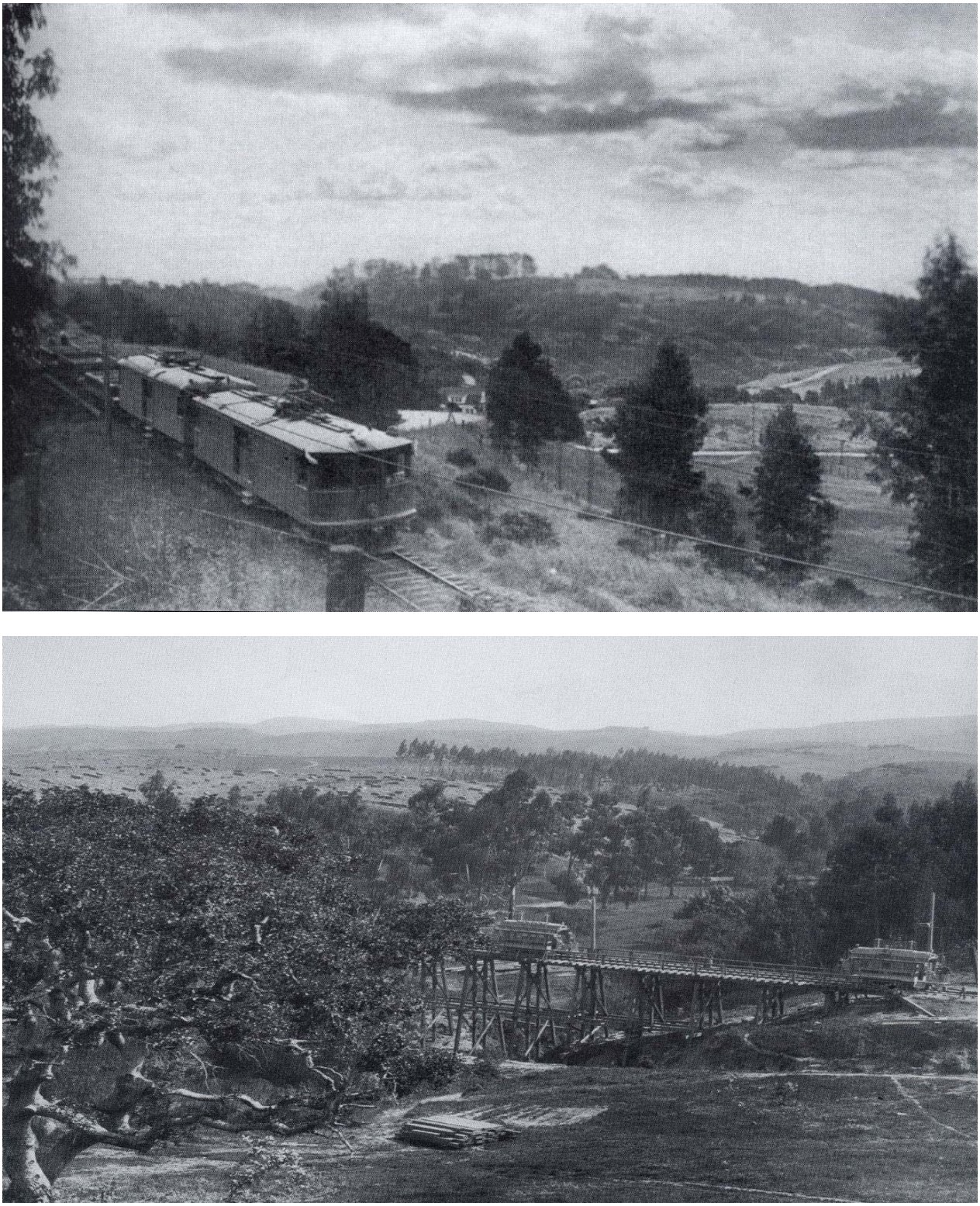

Figure 15: Top: The Oakland and Antioch Railroad (later the Sacramento Northern RR) began in 1909 and went through Montclair and up Shepherd Canyon to a tunnel through the hills. Bottom: Trestle Glen in the late 1800's with the upper Sausal Creek watershed in the background showing the general lack of tree cover.

neighborhood into Shepherd Canyon. Shephard Creek was put into a culvert as part of the railroad development in 1909. The train stopped operating in March 1957. The 1943 topographic map shows extensive road construction in the upper watershed. This development followed the construction of the Leimert Bridge across Dimond Canyon in 1926. Figures 16 and 17 depict the bridge construction and accompanying road and housing development in the Oakmore area.

Figure 14 is the 1959 topo map of the Sausal watershed. Highway 13 and Interstates 580 and 880 are built and most of the watershed is urban. Most of the areas depicted in green in the upper watershed have since been developed. Large sections of Sausal Creek and its tributaries have been culverted and their watersheds covered with urban development (Figure 18). However, land was set aside for parks in a number of locations.

IV. NATURAL RESOURCES

GEOLOGY

Sausal Creek is located along the eastern periphery of the San Francisco Bay (Figure 19). The steep hills on both sides of the bay were formed primarily through tectonic processes. The Pacific Plate is diving beneath and pushing up the North American Plate, crumpling the edge of the continent into the Coastal Range. The San Andreas Fault zone on the San Francisco side of the bay is one of a series of faults which dissect the Bay Area. The faults are areas of earth movement along the continental plates.

Sausal Creek watershed reflects this regional geology with very steep hills in its upper watershed. These hills are made up of a variety of rock types. The Hayward Fault is a major geologic feature which created a valley where Highway 13 is located. Downstream of the Hayward Fault on the flatter lands, Sausal Creek spreads out, creating an alluvial fan and depositing material eroded from the highly sheared rock in the fault zone and the steep upper drainage.

Figure 20 depicts the geologic features of the watershed. Table 2 describes the characteristics of each rock type. Great Valley Complex and Franciscan Complex are the primary geologic formations in the watershed. Franciscan Complex is an ancient sea floor dating from 150-200 million years ago, that has been uplifted through the movement of continental plates. Great Valley Complex is also composed of sedimentary rock and was deposited in a shallow inland sea 70-100 million years ago. Franciscan Complex is the basement rock for much of the San Francisco Bay area. As the Pacific Plate subducted or moved beneath the North American Plate, the Franciscan Complex was crumpled and uplifted into the coastal mountains. Although deposited on top of the Franciscan Complex, the Great Valley Complex rock layers often shifted from their original positions through the process of faulting and uplift.

Surface deposits are also found, including mudstones in the uppermost end of the watershed, and extensive alluvial fan deposits in the lower half of the watershed. These alluvial deposits are formed as the steep hilly area of the drainage erodes, and cobble, sand, and gravel deposit over the flatlands of the lower drainage.

Schumm, Mosley and Weaver (1987) note that
“An alluvial fan is an accumulation of sediment that has been deposited where a debris-laden stream emerges from the confined valley of an upland area onto the piedmont, where it is free to spread laterally and deposit its load. The ideal form of an alluvial fan is semicircular in plan. Because of their